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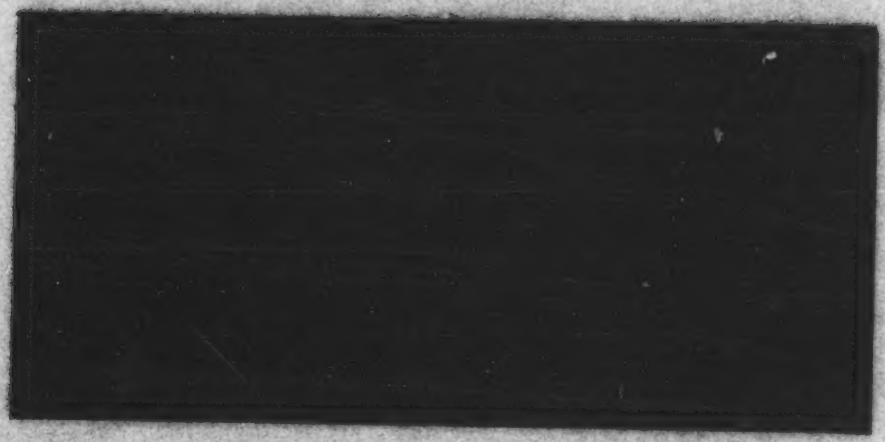

B.C. HYDRO
PEST MANAGEMENT
STRATEGY

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EXECUTIVE SUMMARY

The purchase and use of pesticides are regulated by the Pesticide Directorate of Agriculture Canada and the Pesticide Control Branch of the provincial Ministry of Environment. B.C. Hydro uses herbicides to control unwanted vegetation on rights-of-way, in electrical and industrial compounds, and at dam sites. Wood preservative pesticides are used for the maintenance of utility poles to prevent and control decay fungi and wood destroying insects.

B.C.Hydro's objectives are:

- to eliminate our dependence on herbicides
- to eliminate the release of wood preservative pesticides from utility poles

The use of herbicides for the control of tall-growing vegetation on rights-of-way has been reduced by over ninety percent during the last decade. This has been accomplished by the use of target-species specific control techniques with herbicides, resulting in enhanced biological control. In 1988 our herbicide use for vegetation management on rights-of-way amounted to 0.2 % of the provincial total of pesticides applied under pesticide use permits. More recent B.C. Hydro trials with physical methods of control without the need for herbicides are encouraging.

Site conditions in our electrical and industrial compounds, and at our dam sites, are such that unwanted vegetation is bound to establish. The main reason for weed encroachment at these sites is the bare-ground conditions that have been required. The use of soil sterilant herbicides has caused some off-site chemical migration. In 1989 their use was curtailed pending the development of site-specific prescriptions. To eliminate our dependence on the use of herbicides for these sites, the present specifications and practices must be reexamined.

The use of wood preservatives extends pole life by a factor of three or more. B.C. Hydro's use of wood preservative pesticides for the maintenance of standing poles has accounted for over twenty percent of all the pesticides applied under permit in this province. Rising concern regarding the migration and fate of the wood preservatives, particularly pentachlorophenol (PCP), has given rise to a more restrictive regulatory climate. New restrictions specifically affect the maintenance of standing utility poles near water and virtually eliminate their preventative maintenance. B.C. Hydro has established a Task Force on Corporate Use of Wood Preservatives to examine this issue.

The proposed vegetation management strategy outlines a course of action to eliminate our dependence on herbicides by:

- encouraging secondary uses of the rights-of-way
- exploring physical methods of control
- changing the conditions in compounds to eliminate weed encroachment
- reexamining the requirements and site conditions at dam sites to facilitate physical control methods
- providing enhanced training for staff
- establishing long-term vegetation management contracts

The proposed pole maintenance strategy outlines a course of action to eliminate the release of wood preservative pesticides from utility wood poles by:

- reviewing and determining the preferred wood preservatives and tree species for new poles
- examining alternatives to wood poles
- reviewing and updating treatment techniques and specifications for standing utility poles

B.C.HYDRO PEST MANAGEMENT STRATEGY

PART 1: PREAMBLE

B.C.Hydro must control vegetation on rights-of-way, at dam sites, in electrical yards, and in various industrial compounds. Traditionally, the management of vegetation on these sites has relied heavily on the use of herbicides. In addition, wood preservative pesticides are used for electrical poles, both prior to installation and for the maintenance of standing poles.

The use of pesticides requires adherence to laws and regulations, which B.C.Hydro has diligently followed.

Pesticides are designed and developed to kill target pest species, large and small, and are registered by federal authorities for their intended purpose. Most of these chemicals also affect other living organisms, some are very potent, and some may persist in the environment for a long time. Their use requires a great deal of caution.

In recognition of the fact that pesticides can be harmful to the environment, B.C.Hydro has made significant progress towards reducing the amounts of herbicides needed for control of vegetation on power line rights-of-way. Nevertheless, environmental and public concerns regarding the use of pesticides remain. *It is appropriate, therefore, that B.C.Hydro plan and execute an overall strategy for the future corporate use of pesticides on the basis of the following objectives:*

- **TO ELIMINATE B.C.HYDRO'S DEPENDENCE ON HERBICIDES.**
- **TO ELIMINATE THE RELEASE OF WOOD PRESERVATIVE PESTICIDES FROM UTILITY WOOD POLES.**

The balance of this report is divided into three parts:

Part 2 traces the history of herbicide use by B.C.Hydro. Comparisons are also made to other pesticide uses and other users in the province and in Canada.

Part 3 provides the rationale and proposed strategy for the various areas of vegetation management and for the preservative treatments of power poles to meet our objectives.

Part 4 contains a proposed Action Plan.

PART 2: HISTORY AND CURRENT STATUS

2.1 VEGETATION MANAGEMENT ON RIGHTS-OF-WAY.

In an effort to address increasing environmental concerns and public alarm over the use of herbicides on power line rights- of-way, B.C.Hydro initiated field trials in 1981 to find better and less controversial control techniques.

2.1.1 THE MANAGEMENT TECHNIQUES.

British Columbia's pioneer, tall-growing, deciduous trees and brush are incompatible with power line operations. All, except the maple species, share the common characteristic of being intolerant of shade. Work has concentrated on how to use this characteristic to best advantage. The herbicide application techniques developed are highly target-species specific and have minimal or no impact on low-growing vegetation species. The shade provided by a canopy of low, native brush prevents the germination of the seeds of tall-growing, deciduous species. This type of biological control also increases forage and shelter for many wildlife species.

Mere slashing or mowing of these species results in regeneration of the stumps and roots, thereby dramatically increasing the number of stems per hectare. Physical control methods which do not require a follow-up with herbicides were also investigated, lately with increasing degrees of success.

In developing new control techniques, the emphasis has focussed on achieving relatively stable plant ecosystems with fairly high resistance to invasion by the incompatible, tall- growing trees and shrubs. The operational use of some of the most promising novel techniques developed by B.C.Hydro, has resulted in a substantial reduction in herbicide usage starting in 1983, within two years of initial field trials.

Herbicidal treatment of tall-growing, coniferous species has been abandoned, since slashing of these species provides adequate control and resprouting from the stumps and roots, usually, does not occur.

Aerial broadcast applications of herbicides have not been used by B.C.Hydro for nearly a decade. Blanket broadcast spray and pellet applications from the ground, likewise, have not been used for some time. The future use of these appliocation techniques will require Vice-Presidential approval.

Target-selective, foliar spray applications still are used on rights-of-way in rangeland areas to maintain grazing forage. Target-selective foliar wipe-on application techniques are currently under study which would reduce herbicide use in this agricultural endeavour by up to seventy percent for the first control cycle and to insignificant levels thereafter.

The most drastic reduction in herbicide usage has occurred in wilderness and other areas, where secondary uses do not occur. Recent trials with the new "girdling" technique indicate that two of our major target species, red alder and white birch, may possibly be controlled with this physical technique.

2.1.2 HERBICIDES AND THEIR PROPERTIES.

In past years, herbicides with characteristics which rendered long-lasting control of unwanted vegetation on rights-of-way, were deemed to be most desirable, efficient, and lowest cost. Their use prevented or delayed the enhancement of low brush and produced grasslands which are prone to reinvasion by pioneer trees, once the effects of the herbicides subside. Grasslands in ungrazed forested wilderness areas can spread forest fires quickly and offer little forage and shelter to wildlife.

B.C.Hydro's search for new target-species specific control techniques has focussed on biodegradable herbicides with short persistence in the environment.

Our former dependence on chemicals such as 2,4,5-T; 2,4-D; and picloram has been changed almost exclusively to glyphosate (Roundup). This herbicide of very low toxicity has a half life in the order of 60 days, is readily adsorbed to soil particles and organic matter, while its breakdown products are nontoxic. The new operational technique and herbicide combinations result in less or no persistence and little, if any, adverse effect on the desirable species. Due to the time span of control cycles, a commitment to whatever future strategy is employed, must be long term.

2.1.3 HERBICIDE QUANTITIES USED ON RIGHTS-OF-WAY.

Figure 1, illustrates B.C.Hydro's diminishing dependence on herbicides for right-of-way vegetation management. For comparison Figure 2 shows the trend in the B.C. Forest Industry, Figure 3 portrays B.C.Hydro's herbicide use when compared to other industrial users, Figure 4 illustrates our switch to nonpersistent herbicides, and Figures 5 and 6 illustrate how B.C.Hydro's herbicide use fits into the provincial scene.

Our total average annual herbicide usage is now below 10% of label and permit permissible rates, while yet in the first control cycle. It will diminish further as biological control establishes and the stem count of target tree species is reduced each control cycle (5-7 years).

In 1988, as shown in Figure 6, we used 0.4% of the total active ingredient (a.i.) pesticide applied under permit in British Columbia for all our vegetation control programs, including substations. This quantity of pesticide was applied to 2.6% of the total land area treated under permit by all permittees in the province. Note that B.C.Hydro's use of wood preservatives for the maintenance of standing poles is included in the category "other" and will be addressed later (Part 2.4).

For comparison:

B.C.Rail and C.P.Rail, combined, used 2.5% of the total a.i. pesticide applied under permit and applied this to 0.9% of the total land area. This translates into a per hectare application rate 18 times greater than B.C.Hydro.

Forestry used 42.2% of the total a.i. pesticide and applied this to 65.2% of the total land area. This translates into a per hectare application rate 4 times greater than B.C.Hydro.

These statistics must be put into perspective relative to the total use of pesticides in British Columbia. Pesticides for agricultural and domestic purposes are not included in the totals used under permit in this province and these amounts are not known. However, on a country-wide basis, agricultural and domestic pesticide usage in 1985 amounted to nearly 96.5% of all pesticides used in Canada, as shown in Figure 7. When agriculture is excluded from these 1985 statistics, over 50% of the remaining pesticide amounts are attributed to home owner and other domestic uses.

2.1.4 REGULATORY CONSIDERATIONS.

B.C. Hydro has not lost a Pesticide Use Permit through public appeals since 1981. No appeals were filed against any of our permits during the years 1983, 1984, 1986, and 1988.

The sharp increase in herbicide use in the Forest Industry, as shown in Figure 2, has renewed public opposition to spraying and resulted in four appeals against B.C.Hydro permits in 1989. However, all four permits were upheld by the Environmental Appeal Board and the appellants have promised to give B.C.Hydro an opportunity to address their respective organizations to discuss our programs in more detail.

2.2 VEGETATION IN ELECTRICAL AND INDUSTRIAL COMPOUNDS.

Vegetation in compounds must be controlled for reasons of safety, security, and fire prevention. Bare-ground areas are common at these sites and the reason for weed encroachment. The off-site migration of soil sterilant herbicides, detected at our compounds in 1986, has resulted in a complete review of our management practices.

2.2.1 THE MANAGEMENT TECHNIQUES.

Traditionally, the herbicides used for vegetation control in our compounds are soil sterilants which prevent weed growth fairly effectively for two or more years. Substations, switch yards, capacitor stations, equipment yards, crew compounds, and pole yards have been treated with soil sterilant herbicides on a regular basis. The migration of these herbicides is intended to be minimal. However, our observations in the field have shown clearly that off-site movement does occur. Steps have been taken to stop this phenomenon.

2.2.2 SOIL STERILANT HERBICIDES AND THEIR PROPERTIES.

Soil sterilant herbicides are registered for use on industrial terrain where vegetation must be controlled to ensure safety and to prevent fires. Due to the low tolerance for the presence of weeds, the herbicides used for this purpose are long-lasting and persistent in the environment.

Many of the soil sterilant herbicides are tied up in the soil by colloids and organic matter, both of which are absent by design on industrial terrain. To ensure proper drainage, industrial terrain is generally comprised of sand and gravel which allow migration of the herbicides.

2.2.3 HERBICIDE QUANTITIES USED IN COMPOUNDS.

The extent of herbicide use in B.C.Hydro's compounds amounted to 0.3% of the total pesticides used under permit in the province in 1987 and 0.2% in 1988 (Figures 5 and 6). The use of soil sterilant herbicides was discontinued in 1988 until site-specific prescriptions for their use could be put in place. Consequently, soil sterilants were not used in 1989. The short-term herbicide Roundup was substituted in compounds where vegetation control was urgently needed.

In an effort to reduce our dependence on soil sterilant herbicides, the surfacing specifications for several new sites have been changed. At the American Creek capacitor station, the compound is to be seeded and maintained by mowing. The Lantzville Substation will be blacktopped.

2.2.4 REGULATORY CONSIDERATIONS.

Precautionary measures were undertaken in consultation with the Pesticide Control Branch in Victoria to prevent a recurrence of off-site migration. Site-specific prescriptions are now required of B.C.Hydro and are stipulated as a condition of current Pesticide Use Permits on industrial terrain.

Information about off-site soil types and structures, soil pH, the proximity to water bodies, site drainage patterns, and surrounding land ownership/use was gathered in order to prescribe soil sterilant herbicide use in a more informed manner. More adequate site mapping has been procured and a flow chart has been prepared to identify which herbicides can be used to ensure no unreasonable adverse impact on the environment.

Required site-specific prescriptions are now in place for most electrical compounds.

2.3 VEGETATION AT DAM SITES.

Vegetation at dam sites must be controlled to prevent "piping" and to facilitate seepage detection. These engineering requirements result in bare-ground conditions which are prone to weed invasion.

2.3.1 THE MANAGEMENT TECHNIQUES.

Selective herbicides, selective techniques, and soil sterilant herbicides have all been used to control vegetation at dam sites.

2.3.2 HERBICIDES AND THEIR PROPERTIES.

Soil sterilant herbicides are registered for industrial terrain and can be used at dam sites. The heretofore low tolerance for weeds does require their use if all vegetation is to be controlled. However, the obvious proximity to water of dam sites and the now known characteristic that some of the most effective soil sterilants migrate, virtually exclude their use.

The alternatives include a switch to surfacing materials that do not support weed growth, a reevaluation of engineering requirements, and the more frequent use of herbicides which do not render lasting control.

2.3.3 HERBICIDE QUANTITIES USED AT DAM SITES.

The quantities of herbicides used for dam sites are negligible and have been included with those used for substations (Figures 5 an 6).

The low use of herbicides near dam sites can be attributed to a number of factors:

- Some dam sites are still fairly new and vegetation has not established yet.
- Variances to the engineering requirements have been tolerated, especially with regards to the low-growing vegetation.
- The deep-rooted species are controlled with injection and stump treatment methods.

2.3.4 REGULATORY CONSIDERATIONS.

Pesticide Use Permit Applications for vegetation control near dam sites have been prepared with due consideration and caution for the special environment in which the programs are to be executed. Adverse impacts have not been noticed.

An appeal was launched in 1985 against our dam sites permit in the Kootenays. However, the permit was upheld by the Environmental Appeal Board.

2.4 WOOD PRESERVATIVE PESTICIDE USE FOR UTILITY POLES

Wood poles are presently the most cost-effective utility poles available to B.C.Hydro. They are used extensively for the lower voltage transmission lines and the majority of distribution lines. Wood preservative pesticides extend the service life of these poles from as low as 10 years up to 30 or more years, depending on the tree species. Lately the use of wood preservatives in British Columbia has received increased scrutiny from regulatory agencies. An in-house taskforce is addressing this issue as it pertains to B.C.Hydro and has identified problems with the placement of some utility poles in residential areas and near water sources.

The wood attacking pests.

Utility wood poles are subject to a number of pathogens which attack the wood cells, thereby weakening the structural strength of the poles. In practice the various rots are usually named according to the area of infestation, such as butt rot, heart or internal rot, shell or groundline rot, and pole-top rot. Carpenter ants and termites may also take up residence inside the pole and cause severe structural damage. The presence of insects in the poles attracts woodpeckers which can inflict extensive damage and introduce decay fungi.

2.4.1 THE MANAGEMENT TECHNIQUES.

Preventative treatment of the poles is essential to ensure reasonable pole life.

The wood preservatives used by B.C.Hydro are

for internal rot and insects:

- metam-sodium (Vapam) for internal rot.
  (Note that this pesticide is commonly used as a soil fumigant in agriculture)

for external rot:

- pentachlorophenol (PCP), related polychlorophenols, and borax.
- chromated copper arsenic (CCA).
- ammoniacal copper arsenate (ACA).

Standing, non-treated poles and poles which are butt-treated with PCP require remedial bandage treatments near the ground line every eight or more years, depending on the climate. CCA- and ACA-treated poles are not expected to require this groundline treatment for 30 to 40 years.

All wood poles require "test and treat" programs to check for internal rot and to assess the pole's remaining strength. The test holes must be treated and plugged to prevent pathogen entry. Pole-top rot treatments are less frequent and usually required for older poles, most of which have not been full-length treated prior to installation.

The compounds used for external pole treatments are more toxic and persistent than the herbicides used by B.C.Hydro. PCP-treated poles which are taken out of service are now considered hazardous waste. Contaminants in PCP's are proven carcinogens.

Of particular worry is the tendency for "bleeding" and leaching of some PCP-treated Douglas fir poles. Recently, a number of poles with these highly visible characteristics had to be replaced in the Lower Mainland area. At this time, there are no indications that the remedial bandage techniques used for standing poles have contributed to leaching. A good portion of our standing pole plant would be put at risk if external groundline treatments were to be abandoned.

2.4.2 WOOD PRESERVATIVE PESTICIDES AND THEIR PROPERTIES

These compounds can be divided into two groups:

- Inorganic, composed of naturally occurring compounds.
- Organic compounds, manufactured by man.

INORGANIC COMPOUNDS.

-ammoniacal copper arsenate (ACA) is a highly toxic arsenic compound. The arsenic and gasseous ammonia can cause chronic effects in workers at treatment plants, the copper in this compound is highly toxic to aquatic life. Properly fixed, it is tightly held in the wood and does not leach. This compound is corrosive to metal, however this characteristic can be managed.

-borax is formulated with polychlorophenols for wood preservation in utility poles. It has low toxicity, but is harmful to plants and must be kept out of the root zone.

-chromated copper arsenate (CCA) is another highly toxic compound, similar to ACA. Properly fixed, it does not leach. CCA is used widely for utility poles, landscape timbers, house siding, patios, and playground equipment.

-sodium fluoride has in the past been formulated with other wood preservatives. It is identified as a suitable replacement for PCP in remedial bandages for groundline treatments. Registration by Agriculture Canada for this purpose is pending.

ORGANIC COMPOUNDS.

-copper naphthanate is an organic compound used for wood preservation, including utility poles. It has been registered for this purpose for a long time, but it is not registered for remedial bandage treatments. Copper naphthanate has been identified by the Canadian Electrical Association (CEA) as a suitable replacement for PCP in bandage treatments. Registration is pending.

-metam-sodium is a man-made organic liquid used in agriculture as a soil fumigant. It is also used for utility poles to treat internal rot, and to control carpenter ants and termites. The liquid metam-sodium has a low mammalian toxicity, the gaseous methyl-isothiocyanate it produces in contact with oxygen and water, is hazardous. However, when properly handled, the chances of exposure are slight.

-pentachlorophenol (PCP) (and related polychlorophenols) is an effective herbicide and was registered for this purpose in the past. It is still registered as a wood preservative for its fungicidal and insecticidal properties. PCP is used extensively for wood preservation, including utility poles. It is moderately toxic, but accumulates in the body fat tissue and can cause sudden chronic effects. It belongs to the organochlorine group of chemicals, most of which have been removed from use (DDT, aldrin, dieldrin, etc.).

2.4.3 B.C.HYDRO'S WOOD PRESERVATIVE PESTICIDE USE.

B.C.Hydro has some 878,000 poles in service, of these 134,000 were not treated prior to installation, 258,000 are butt treated, and 486,000 are full-length treated. New poles are mostly full length treated, although many new poles for the dry interior are only butt treated. In the last few years, approximately 50% of the poles for Customer Services were treated with CCA, and the remainder with PCP. However, CCA- and ACA-treated poles account for only 6.5% of the the total number of utility poles in service.

The most extensive use of pesticides by B.C.Hydro is in the preventative maintenance of standing poles. Over one-fifth of all the pesticides used under provincial permits during 1987 and 1988 is attributed to B.C.Hydro's pole maintenance (Figure 8). This does not include the amounts used in new poles which, ironically, can be installed without permit. This year, B.C.Hydro has adopted the norm of carefully assessing the locations where new poles are to be installed and of specifying CCA rather than PCP for placement near water sources.

2.4.4 REGULATORY CONSIDERATIONS.

Concerns about the use of PCP, a persistent organochlorine compound, has prompted the Pesticide Directorate in Ottawa to ask for the voluntary registration withdrawal by the manufacturers.

Fear is that the cancellation of the registration by regulatory officials in Ottawa could trigger a public furor greater than the reaction to PCB's.

B.C.Hydro has imposed a moratorium on the further purchase of PCP-treated poles and products containing this man-made organic compound. No replacement is available at this time for the groundline bandage treatments.

Registrations for the use of copper naphthanate and sodium fluoride (another suitable wood preservative) in remedial bandages have been stagnated in Ottawa for several years. Indications are that the voluntary withdrawal of the PCP registration by the manufacturers, would accelerate the registration of the new products.

Provincial permits are not required for the treatment or placing of new poles, even though greater quantities of wood preservatives are involved.

Provincial Pesticide Use Permits for the treatment of standing poles, applied for in the fall of 1989, have not been forthcoming. Consequently, treatment programs in the Vancouver Island, South Interior, and Northern Division areas are halted. The Lower Mainland permit expires at the end of June 1990.

The Pesticide Control Branch has indicated that pesticide- free-zones near water bodies may be increased to 5 metres from the current 1 metre. Such a permit condition excludes a large portion of our standing pole plant from treatments in the future. Word is that the new permits will soon be granted with the new restrictions.

The unscheduled halt in pole treatments has delayed this year's maintenance programs and is most serious for internal pole treatments. The pole strength measurements cannot be carried out without the risk of introducing the very pathogens we are trying to avoid. This may present a serious safety hazard when poles fail near populated areas and roadsides.

PART 3: PROPOSED STRATEGY FOR B.C.HYDRO.

3.1 VEGETATION MANAGEMENT ON RIGHTS-OF-WAY

Nature's responses to man's interference are often predictable. This is particularly true in vegetation management on rights-of-way. The degree of our interference in plant ecosystems usually is met with an equal or greater response of regrowth. When clearing disturbances to the plant community and terrain are minimal, the low-growing shrubs and other ground-covering plants establish biological control more quickly.

The following describes the major strategic initiatives which are recommended to reach our objective of eliminating our dependence on herbicides for the control of unwanted vegetation:

- **PROMOTE COMPATIBLE SECONDARY USES ON RIGHTS-OF-WAY.**
- **ESTABLISH BIOLOGICAL CONTROL ON RIGHTS-OF-WAY IN WILDERNESS AREAS AND IN AREAS NOT EFFECTIVELY CONTROLLED BY SECONDARY USES.**
- **PROVIDE ENHANCED TRAINING FOR STAFF TO BROADEN THEIR UNDERSTANDING OF VEGETATION MANAGEMENT PRINCIPLES.**
- **EMPLOY LONG-TERM CONTRACTS FOR THE MANAGEMENT OF RIGHTS-OF-WAY.**

3.1.1 SECONDARY USES OF THE RIGHTS-OF-WAY.

Secondary uses of our rights-of-way should be encouraged, provided that these uses are not detrimental to the environment, the safety standards are adhered to, and a cost effective balance in vegetation management is achieved. *Some appropriate secondary uses are:*

Farm crops
Grazing pasture
Rangeland grazing
Tree nurseries
Christmas tree farms
Landscaped areas in urban/suburban areas
Recreational uses

B.C. Hydro must be prepared to assist in improvement of the land, as required, to render such secondary uses viable. The objective should be a notable contribution to the community and a long-term cost saving to the corporation.

3.1.2 BIOLOGICAL CONTROL: THE MANAGEMENT TECHNIQUE.

The most troublesome tree species on our rights-of-way are red alder, mountain alder, bigleaf maple, Douglas maple, northern black cottonwood, aspen poplar, and white birches.

All of these and some other deciduous tree species develop multiple stems when mowed or slashed. Control is presently achieved by individual stem or stump treatments with the herbicide glyphosate (Roundup). The development of low brush and other ground-covering plants prevents the problem tree seeds from germinating.

To meet the proposed objective of eliminating our dependence on herbicides, physical control methods have been sought that will prevent resprouting of the problem species without the need for herbicides. Possible alternative physical control techniques have not been identified yet for the aspen poplar which is found on our rights-of-way throughout the province's interior. When mowed or cut, profuse resprouting of the stumps and roots render this species difficult to control under the best of circumstances. Our search for potential physical control of this species continues. The progress made in physical and other management techniques for all species is discussed below.

PHYSICAL CONTROL TECHNIQUES.

Clearing.

Disturbed soils are prone to invasion by native, pioneer, tall-growing, deciduous, broadleaved trees and brush. This is nature's way of ensuring optimal photosynthesis and replenishment of the soil, to prepare the environment for the eventual reestablishment of the climax coniferous forest.

In order to minimize the regrowth of the deciduous, broadleaved species which are incompatible with electrical power lines, soil disturbance must be kept to a minimum, both during the initial clearing of new rights-of-way and in the future maintenance of the lines. This will establish biological control more quickly.

Secondary uses of the land under power lines must be identified prior to any clearing projects. In wilderness areas, a vegetation survey must identify both target species to be removed and desirable vegetation with biological control potential, prior to specifying clearing standards. Generally, machine clearing which creates bare-ground conditions, must be avoided. Timing the initial clearing while the ground is frozen, or covered with snow, will minimize disturbances. Specialized equipment which minimizes disturbance of the soil and plant community can be used at other seasons of the year, both during initial clearing and in future maintenance of the rights-of-way.

Girdling.

In the girdling technique, a strip of bark is removed around the trunk of the tree. The above ground parts of the tree continue to grow, but the roots do not. Many tree species so treated, die as a result, depending on the regenerative capabilities of the species. Red alder and white birch appear to respond readily to this treatment, black cottonwood and mountain alder are other target tree species that can probably be managed with this technique. All are major target species on our rights-of-way.

Field trials are required to determine the full potential of this technique. *However, the following is known at this time:*

- Tree mortality may not occur until two or three years after treatment.
- The tree must remain standing, and some continued growth occurs after treatment.
- Due to the continued growth, some topping may be required at the time of girdling to avoid flashovers to tree tops in close proximity to the conductors.
- Since the trees must remain standing, aesthetic impacts must also be considered.
- Girdling is most effective on single-stemmed trees. In previously slashed areas, resprouting produces multiple stems which greatly hampers the effective removal of the strip of bark.

Black Plastic.

The bigleaf and Douglas maples respond to the girdling technique as to slashing, i.e. by multiple resprouting from the stumps. However, they do not resprout from the roots. Covering the cut stumps with black plastic may prevent the resprouting. This technique needs to be field tested.

Other Physical Control Possibilities.

As mentioned earlier, the deciduous problem species on our rights-of-way respond to mowing and slashing by multiple resprouting from the stumps and/or roots. The more juvenile trees resprout most vigorous. Slashing the trees when the carbohydrate reserves are low, reduces and at times eliminates the resprouting. This phenomenon may be explored by researching the sugar levels in the trees at which the resprouting ceases. Although it is not possible to do all our right-of-way work in this relatively brief "window", by rotating our slashing time frame over several control cycles it may be possible to utilize this feature.

Our search for other viable physical control techniques continues.

CHEMICAL CONTROL TECHNIQUES.

As has been shown earlier, our dependence on herbicides has been reduced dramatically. Large areas are now controlled by individual stem treatments. This has enhanced biological control in ways now very evident on many of our rights-of- way. Further substantial cuts in our per hectare herbicide rates can be achieved fairly quickly. *However, it must be realized that in the short term, herbicides are still needed to improve the overall condition in some areas.* Particularly in areas where mowing has caused extensive muptiple stem growth, there are at present no known physical methods which will achieve biological control. Control cycles ranging from five to seven years, do not allow for changes overnight.

Further research is needed, therefore, to permit a reduction in chemical usage while suitable physical methods are explored. Meanwhile, blanket foliar spray application should be discontinued altogether.

Capsule Injection/Carbopaste Applications.

Roundup, containing the a.i. **glyphosate**, is now the most widely used herbicide by B.C.Hydro for these target-tree specific applications. Our reduction in herbicide use is largely because of these techniques. However, they are not registered label uses. So far we have been allowed to continue their use, due to the very low application rates. We are nevertheless vulnerable if there should be a change of regulatory minds.

The herbicides **triclopyr** and **ammonium sulphamate** have been identified as possible replacements. The latter turns into fertilizer soon after application.

Foliar Wipe-On.

Mechanical mowing of the deciduous, broadleaved target species sharply increases the stem count per hectare, if a follow-up treatment with herbicides is not carried out. Cut stumps can be individually treated effectively with very small quantities of herbicide, but this treatment is not feasible on the splintered stumps caused by mowing. A selective foliar spray on the regrowth will render control, but also affects much of the desirable vegetation.

The foliar wipe-on technique facilitates selective control of the target species by height adjustment of the rotating application wick. The herbicide application rate per hectare is reduced substantially.

The following herbicides have been identified for use with the foliar wipe-on technique:

- **Tordon 101 (2,4-D and picloram), currently used for selective broadcast applications on rangeland.**
- **glyphosate**
- **triclopyr**
- **ammonium sulphamate**

3.1.3 TRAINING.

The effective management of vegetation on rights-of-way requires an understanding of how vegetation responds to our intervention. A plant identification booklet is presently in preparation to assist field personnel in identifying both problem and desirable species. *An in-house training program is recommended to provide staff with information about the principles of vegetation management.*

3.1.4 LONG-TERM VEGETATION MANAGEMENT CONTRACTS.

Vegetation control strategy must be a long-term commitment. At present, vegetation control contracts are let annually on an "as needed" basis.

The inspection of right-of-way conditions, preparation of tender documents, selection of contractors, prejob instructions, and inspection of completed work are all time consuming and costly.

Different contractors have different equipment and working habits. The good work done by one contractor can be undone by another during the next control cycle. Job security for contractor personnel is low and job experience suffers.

Long-term Vegetation Management Contracts, whereby a contractor is assigned to manage a predetermined length of right-of-way for say 15 years (2-3 control cycles), need to be examined. Local contractors, who have greater knowledge of local conditions, should be encouraged to bid. Long-term contracts would encourage the development of novel solutions to specific local problems, by work forces who have a greater stake in the quality of work they do. Out of town expenses, administration costs, and job extras would be reduced. Local people would deal with local public concerns.

3.2 VEGETATION IN ELECTRICAL AND INDUSTRIAL COMPOUNDS.

B.C.Hydro's electrical and industrial compounds require vegetation control to ensure electrical safety for our workers and the public, and for fire prevention. The integrity of fence lines is of great importance at our compounds; encroaching weedy trees and brush pose both a security and a safety hazard.

The current bare-ground condition of many of these compounds does not offer an opportunity to forego the use of soil sterilant herbicides, without compromising safety standards. To meet the objective of eliminating our dependence on herbicides, we must eliminate the opportunity for weeds to grow. *The following strategy is proposed:*

- **EMPLOY PHYSICAL METHODS FOR WEED CONTROL BY CHANGING THE SURFACE CONDITIONS AT OUR COMPOUNDS.**
- **IN THE INTERIM, ENSURE THAT SITE-SPECIFIC PRESCRIPTIONS ARE IN PLACE FOR AREAS WHERE VEGETATION CONTROL IS ESSENTIAL.**

3.2.1 THE PHYSICAL MANAGEMENT TECHNIQUES.

The need for bare-ground conditions must be reexamined and abandoned where possible. Maintained grassed areas as proposed for the American Creek capacitor station is a solution for at least portions of many other compounds. Blacktopping, as proposed for the Lantzville substation, may be a solution elsewhere.

Landscaping.

The appearance of many of B.C.Hydro's compounds can be improved by screening the compound with landscaped areas outside the fence lines. Particularly in populated areas, such a strategy would be appreciated. Areas which can be seeded to grass and maintained by mowing must be identified.

Crushed Rock.

The use of a 15 cm layer of washed crushed rock under electrical installations greatly reduces the invasion of weedy plant species. The few weeds that do establish can easily be hand pulled.

Crushed Limestone and Blacktop.

The travelled portions in most compounds contain sand and soil which support weed growth. Mechanical or manual removal of the weeds in these areas, disturbs the surface and prepares the ground for the germination of more weed seeds.

Hard surface materials can be used to control weed growth. A 10 cm layer of gray, crushed limestone prevents most weed growth. Weeds that do establish can be removed by physical means and the surface can be repaired. This material is used successfully for walks in parks, sidewalks, and driveways.

The integrity of fence lines is of great importance of our compounds. Blacktopping up to 1 metre on both sides of the fence will eliminate weed growth in this vulnerable area.

The maintenance of our compounds is a long-term requirement and is done on a regular and as required basis. The long-term management contracts recommended for rights-of-way are also recommended for electrical and industrial compounds (See Part 3.1.4.).

3.2.2 SITE-SPECIFIC PRESCRIPTIONS.

The proposed strategy described above will take time to put in place. Although herbicide use is unavoidable in the interim, much has been done recently to effect an immediate reduction in their use.

The use of blanket soil sterilant applications for prolonged control is the principal reason for the off-site movement we have experienced. Such applications must only be used sparingly to address specific weed problems.

Site-specific prescriptions have largely been put in place for 1990. They are designed to reduce the off-site movement of soil sterilant herbicides from our compounds. Emphasis has been placed on the use of the least persistent herbicides that will render the required control.

Site-specific prescriptions must be kept current and address specific weed problems as they occur. Spot spraying with Roundup can be followed up with simazine at shelterbelt rates on an "as needed" basis. Both of these herbicides will eliminate off-site movement, when applied properly.

To eliminate our present dependence on herbicides, future site-specific prescriptions must include recommendations for site improvements as discussed above.

3.3 VEGETATION MANAGEMENT AT DAM SITES

The engineering requirement that vegetation on dams must be controlled to facilitate seepage detection and to prevent "piping" caused by roots. should be reassessed.

As in our compounds, the bare-ground areas at dam sites must be changed to facilitate physical controls.

The following strategy is proposed:

- **EMPLOY PHYSICAL METHODS FOR WEED CONTROL BY CHANGING THE SURFACE CONDITIONS AT OUR DAM SITES.**
- **IN THE INTERIM, ENSURE THAT SITE-SPECIFIC PRESCRIPTIONS ARE IN PLACE FOR ALL AREAS WHERE VEGETATION CONTROL IS ESSENTIAL.**
- **PROVIDE ENHANCED TRAINING FOR STAFF.**
- **EMPLOY LONG-TERM MANAGEMENT CONTRACTS.**

3.3.1 THE PHYSICAL MANAGEMENT TECHNIQUES.

The need for bare-ground conditions at our dam sites must be reexamined. Landscaped areas, grassed areas, low native shrubs, and changed hard surface areas can be used to eliminate our dependence on herbicides.

Landscaping.

Attractive landscapes are already present near some of our dam facilities. All should be examined to identify further improvements that can be made. Regularly maintained grassed areas will also eliminate the need for herbicides.

Grazing Areas and Native Brush.

Many dikes in this province and in other countries are grassed and grazed. This reduces the occurrence of tall- growing, deep-rooted trees and shrubs. The presence of low brush may also pose no threat to the integrity of some dams and their presence further reduces the occurrence of deep-rooted problem species. Such vegetation can also serve as a deterrent against erosion.

Crushed Limestone and Blacktop.

These materials can be used in travelled areas where the surface fines are now supporting weed growth.

3.3.2 SITE-SPECIFIC PRESCRIPTIONS.

Herbicide Use.

The degree to which vegetation can be allowed to grow on dam sites determines the extent to which herbicides must be used for their control. The girdling technique can possibly be used for many of the tall-growing tree species. If low-brush and grasses can be permitted to establish, the need for herbicides would be negligible. The short-term reliance on herbicides is inevitable until site conditions are improved. *Nevertheless, immediate measures can be implemented to decrease their use and lessen their adverse impact:*

- **Eliminate the use of soil sterilant herbicides.**
- **Eliminate the use of selective broadcast spray applications.**
- **Use herbicides that biodegrade quickly and with a half life of no more than 90 days.**

Interim herbicide usage must be by site-specific prescription only. Such prescriptions should include recommendations for alterations in the overall landscape.

3.3.3 TRAINING.

A basic knowledge of weed species and their response to water may well assist the dam inspector in determining where seepage does occur.

3.3.4 LONG-TERM MANAGEMENT CONTRACTS.

As noted in section 3.1.4, long-term contracts should be considered. Vegetation Management on dam sites should include consideration of secondary uses.

3.4 WOOD POLE PRESERVATIVES FOR POLE MAINTENANCE.

The B.C.Hydro Task Force on Corporate Use of Wood Preservatives is presently looking at all alternatives to the use of PCP for new pole installations and for standing poles. A moratorium on PCP has been recommended in favour of CCA. *Through the Task Force we should continue to examine all options.*

The following strategy is underway:

- **REVIEW AND DETERMINE THE PREFERRED WOOD PRESERVATIVES, TREE SPECIES, AND SPECIFICATIONS FOR NEW UTILITY POLES.**
- **EXAMINE ALL ALTERNATIVES TO WOOD POLES.**
- **REVIEW AND UPDATE TREATMENT TECHNIQUES AND SPECIFICATIONS FOR STANDING POLES.**

3.4.1 NEW UTILITY POLES.

Options for new poles must be fully examined. These options must include alternative wood preservatives, Pultrusion fibreglass poles, hollow sawdust-polymer poles, plywood poles, concrete poles, and tubular steel poles.

Quality control specifications for new, treated wood poles must be strictly enforced, to ensure that losses of wood preservatives in the field do not occur. To that end, the CCA wood preservative must be properly fixed in new poles prior to their placement in the field. Current specifications must be reviewed to ensure this can be achieved.

The new Pesticide Use Permit restrictions near water bodies will exclude many of B.C.Hydro's standing poles from remedial maintenance treatments. The future selection of pole construction materials must take into account their placement in the field in proximity to water bodies and other water sources.

3.4.2 MAINTENANCE TECHNIQUES FOR STANDING POLES.

Alternative techniques to the treatment with wood preservatives of standing poles, especially those near waterbodies, must be examined. Stubbing may be one viable alternative. Consideration must be given to the stubbing materials, e.g. wood, concrete and/or steel.

Generally, the treatment with wood preservatives of standing poles must be given greater attention to ensure that contractors are provided with clear instructions and that these are carried out.

Standing poles which show excessive PCP bleeding in populated areas and near water bodies must be replaced.

New Wood Preservatives for Groundline Treatments.

Several wood preservatives are effective for groundline treatments and more acceptable environmentally. However, they are not registered for this use in Canada. The early registration by the Pesticide Directorate of Agriculture Canada for the use of copper naphthanate and sodium fluoride in groundline bandage treatments, must be sought in cooperation with the Canadian utility industry.

3.5 PUBLIC INFORMATION AND CONSULTATION.

B.C.Hydro's practices of nearly a decade ago have contributed greatly to the perception that the general public has today about our vegetation management control practices. Our current emphasis on biological control and low use of herbicides, is not widely known.

Presentations have been made to municipal and regional district councils, municipal officials, water boards, a fish and gun club, local rate payers, environmental groups, a high school, and university students. Several brochures have been produced to better inform the public. Nevertheless, a yet greater effort is needed to convey our changed approach and practices to the public.

Generally, the public demands to know what is happening in their backyards. If we are to have any credibility, these demands must be accommodated.

Every effort must be made to inform the public about planned vegetation management programs on rights-of-way, at dam sites, and in compounds. Required regulatory advertisements must be extended to local newspapers and include a contact name and phone number.

Presentations to B.C.Hydro employees about our vegetation control practices should also be undertaken, so that they can assist in getting our message out to the public and know where to direct the public for more complete information.

PART 4: ACTION PLAN

4.1 VEGETATION MANAGEMENT ON RIGHTS-OF-WAY

- Put in place a long-range plan for all rights-of-way, encompassing all secondary uses, special agreements with landowners, interest groups, and individuals. The vegetation species which are incompatible with the power lines will be identified and listed. The long-range plan will be based on local annual growth increments of the fastest-growing target tree and brush species. In wilderness areas the desirable species which enhance biological control will be identified and listed. The intended ultimate condition of the right-of-way will be identified in the long-range plan along with the available control techniques to achieve this condition. The control techniques will be adjusted as required to reflect advancing technology.

- Based on the long-range plan, annual plans will be prepared two years in advance to accommodate regulatory requirements, public consultation, and budgeting. The annual plans will list the control techniques to be used in the control programs. Progress towards the intended goal will be noted and reported prior to each control cycle.

- Broadcast applications of herbicides will require Vice-Presidential approval.

- Research will be done to identify new physical control techniques which eliminate and/or reduce current uses of herbicides.

- Research will be done to find application techniques for herbicides which are target-species specific, further reduce current uses of herbicides, and have no or reduced adverse affect on desirable vegetation species, so that biological control is enhanced.

- Long-term vegetation control contracts will be pursued with preference given to local contractors.

4.2 VEGETATION CONTROL IN COMPOUNDS

- The ground surfacing conditions which will reduce weed encroachment and eliminate the need for chemical controls will be identified for each compound. A long-range schedule will be drawn up to gradually improve ground surfacing conditions.

- Annual vegetation control plans will be prepared at least one year in advance to accommodate regulatory requirements and to facilitate timely neighbour notification. Site-specific prescriptions will be prepared annuallly for each compound requiring vegetation control.

- Before site-resurfacing improvements are in place, glyphosate (Roundup) and simazine at shelterbelt application rates will be used to control vegetation until conditions require soil sterilant herbicides to control specific persistent weed problems. Soil sterilants will be only be applied on a spot application bases and not to the whole site.

- Long-term vegetation control contracts will be pursued with preference given to local contractors.

4.3 VEGETATION CONTROL AT DAM SITES

- The engineering requirements for vegetation control to ensure dam safety will be reviewed.

- The ground surfacing conditions which will reduce weed encroachment and eliminate the need for chemical controls will be identified for each dam site. A long-range schedule will be drawn up to gradually improve ground surfacing conditions.

- Annual vegetation control programs will be planned two years in advance to accommodate regulatory agencies, to allow for public consultation, and to facilitate budgeting. Herbicide use will be by prescription only.

- Before site-resurfacing improvements are in place, target-species specific herbicide application techniques will be used to control tall-growing, deep-rooted vegetation. Glyphosate (Roundup) and simazine at shelterbelt rates will be used to control other vegetation when required.

- Soil sterilant herbicides will not be used at dam sites without Vice-Presidential approval.

- Long-term vegetation control contracts will be pursued with preference given to local contractors.

4.4 WOOD POLE PRESERVATIVE USE

The B.C. Hydro Taskforce on Corporate Use of Wood Preservatives will be empowered to develop Corporate Policy regarding:

- The type of poles to be placed near fish habitat, other water bodies, and ditches.
- The removal of PCP-bleeding poles.
- The disposal of redundant utility wood poles.
- Remedial action for wood preservative contaminated sites.
- The tree species, treatment techniques, and specifications for utility wood poles.
- Alternatives to wood poles.
- The maintenance of standing utility poles.

4.4 PUBLIC INFORMATION AND CONSULTATION

A Public Information and Consultation Program will be developed to fully inform the public of our vegetation management practices, the extent of our current herbicide use, and our corporate objectives.

In particular:

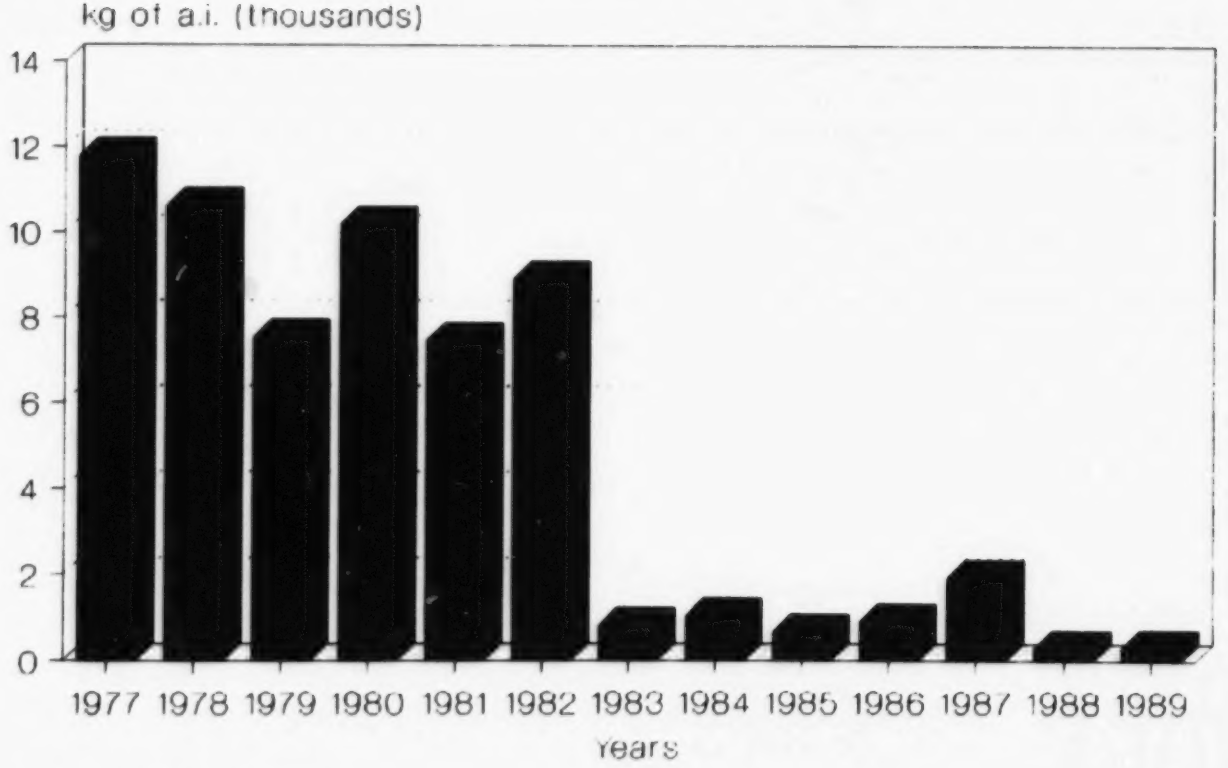
- Our approach to vegetation management will be consistent throughout the corporation.
- The public will be informed through local newspaper advertising of our vegetation control plans on rights-of-way, prior to pesticide-use-permit applications being submitted to regulatory agencies.
- Every effort will be made to address controversial issues before vegetation control programs are carried out.

APPENDIX A

Figure 1

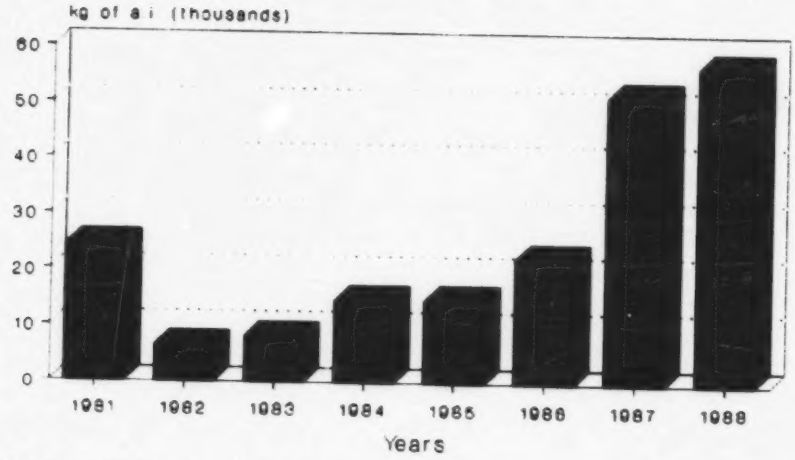
Total Transmission Line Herbicide Use

1977-1989



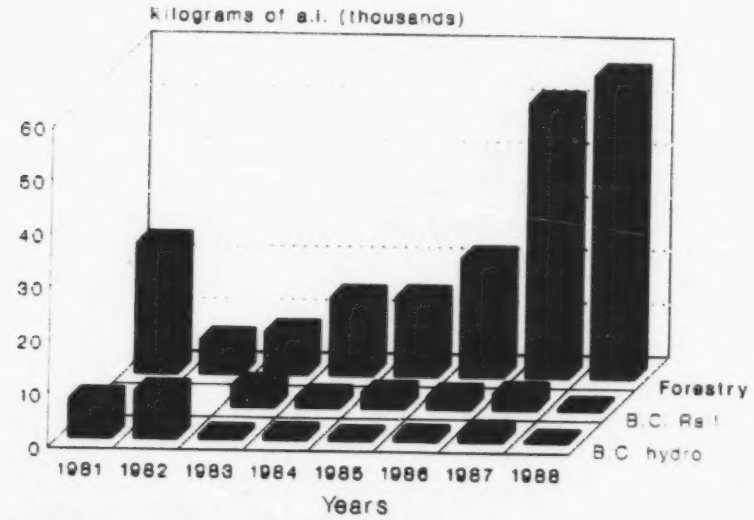
*1981 data is based on the proposed amount of herbicide for the RCW management program

Figure 2 Total Forestry Herbicide Use
1981-1988



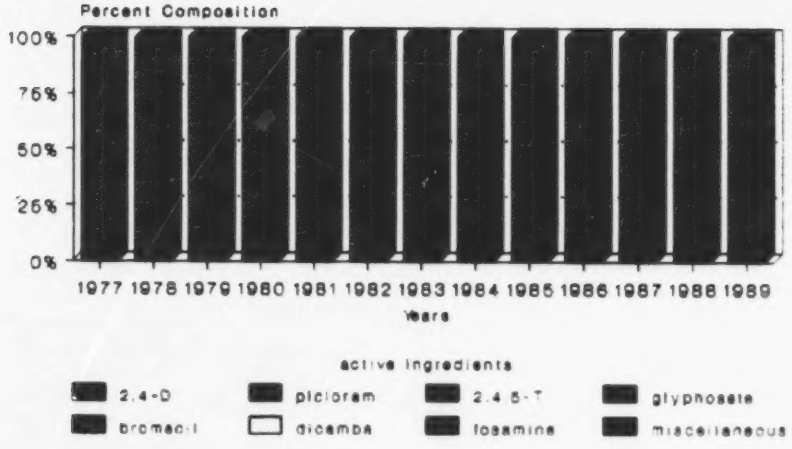
** MOF and Forest Industry data have been added together

Figure 3 Total Active Ingredients Used



** Data is not available for B.C. Rail for 1981 and 1982

Figure 4 Transmission Line Herbicide Use
1977-1989



**1981 data was based on the proposed amount of herbicide for the ROW management program.

Figure 5a. Corporations - Permitted Pesticide Use

Total Permitted Pesticide Use: 133018 kg of a.i.

* Herbicide Use Only
** Including insecticides, fungicides, herbicides and wood preservatives

Figure 5b. Corporations - Area Covered

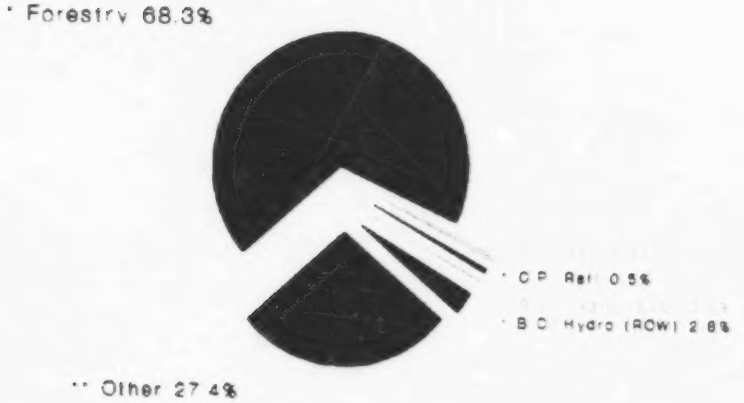


Figure 6a. Corporations - Permitted Pesticide Use

1986

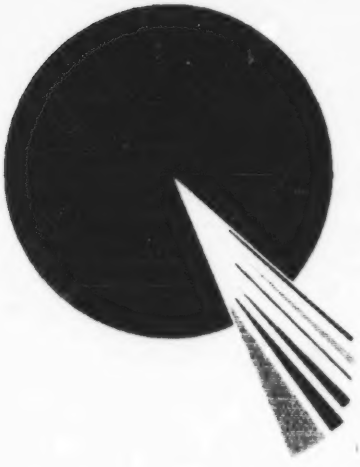
Total Provincial Permitted Pesticide Use: 136074 kg of a

* Herbicide Only
** Including insecticides, fungicides, herbicides and wood preservatives

Figure 6b. Corporations - Area Covered

1986

Figure 7a. RELATIVE USE OF PESTICIDES IN CANADA



1985

Representing kg of active ingredient
Information based on pesticide usage
and sales data for 1985
from Manitoba Agriculture
Economic Analysis Branch & The
Crop Protection Institute of Canada

B.C For Herbicides 0.2%

B.C.For Insecticides 0.1%

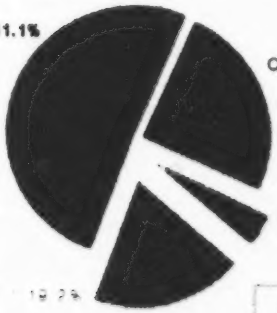
Can For Insecticides 1.1% *

Industrial 1.4% **

* Exclusive of British Columbia

** Includes all utilities. B.C. Hydro portion too small to show

Figure 7b. Canadian Pesticide Use
(not including Agriculture)



DOMESTIC 51.1%

1985

Cdn.Forestry ** 28.3%

B.C Forestry 4.4%

INDUSTRIAL * 16.2%

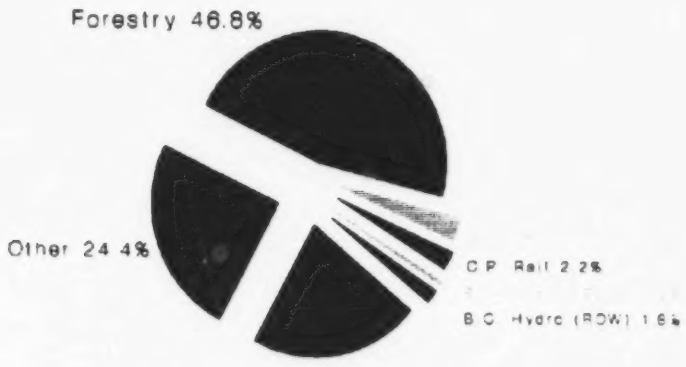
Representing kg of active ingredient.
Information based on pesticide usage
and sales data for 1985
from Manitoba Agriculture
Economic Analysis Branch & The
Crop Protection Institute of Canada

* Includes all utilities

** Not including B.C.

Figure 8a. Corporations - Permitted Pesticide Use

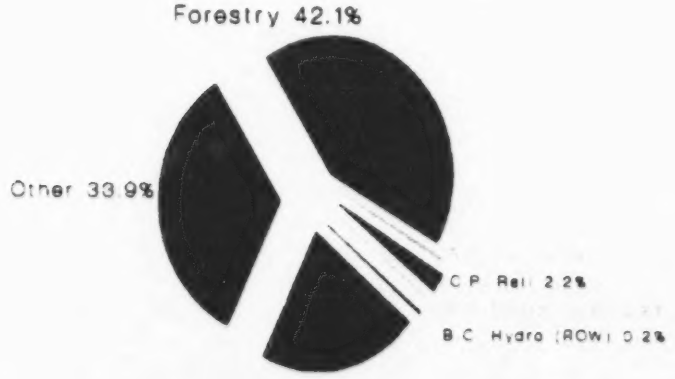
1987



Total Provincial Permitted Pesticide Use 133018 kg of a.i.

Figure 8b. Corporations - Permitted Pesticide Use

1988



Total Pesticide Use: 135074 kg of a.i.